POPULATION STRUCTURE OF THE INDIAN HOUSE RAT, *RATTUS RATTUS RUFESCENS* IN THE INDIAN ARID ZONE[1]

RANJAN ADVANI AND B. D. RANA[2]

The Common house rat, *Rattus rattus rufescens* (Gray) were trapped from January 1980 to December 1980 by live Sherman traps from grain storages in Jodhpur (26°18′N —73°01′E). The females were found to be apparently heavier than males. On an annual basis, collection of females in pre-ponderance of males seems to be necessary to maintain higher densities of population in godowns. Subadult populations were recruited in greater proportion during all the months of year except January which is essential for faster regulation of a dense population of rodents.
A comparison of body weights, sex ratios and age structure of *R. rattus rufescens* has been made with available data of other Indian rodent species.

INTRODUCTION

Although intensive population studies have been carried out on field rodent species, little is known about the bionomics of the commensal rodents in the Indian desert. Constituting about 75 per cent of the total house rodent fauna, the Indian house rat, *Rattus rattus rufescens* is a well distributed species causing severe losses to the food grains in storage. Moreover, *Rattus rattus rufescens* litters throughout the year (Rana *et al.* 1982) and thus has attained a level of economic importance in the Indian desert (Cowan & Prakash 1978).

Keeping in view, the relative abundance, and economic status of this rat, studies have been undertaken at Central Arid Zone Research Institute, Jodhpur on ecology, biology and toxicology (Prakash *et al.* 1980, Advani *et al.* 1981, Rana *et al.* 1982). To make control operations more effective as well as meaningful and operation oriented, seasonal variations in body weights, sex ratios and age structure were studied in the Indian desert rodents, the results of which are reported and compared with those of the field rodents.

MATERIAL AND METHODS

The house rats (200 ♂♂, 242 ♀♀) were sampled from January 1980 to December 1980 with the help of live sherman traps from the grain *mandis* in and around Jodhpur (26°18′N —70°01′E). The Sherman traps were baited with peanut butter and were checked after every 6 hours, during which bait was replenished. After collection, the body weights of rats representing various age-groups and sexes were recorded on a spring balance (accuracy of 0.1 g). After killing the rodents with chloroform, they were sexed and grouped in two classes according to their body weights. Among males, those rats weighing under 80 g were considered to be subadults as they attain sexual maturity at about this body weight (Rana *et al.* 1982). Females having body

[1] Accepted March 1982.

[2] Coordinating & Monitoring Centre for Rodent Research & Control, Central Arid Zone Research Institute, Jodhpur.

weights lesser than 70 g were classified as subadults (absence of Corpora lutea and perforate vagina) while rest were considered as adult.

Results

Body weights

There were no statistical differences in seasonal variations in both the sexes of rodents. However, maximum body weights were recorded during May-June and November-December in males and during February-March and August-September in female rodents (Table 1). The males were found to be apparently heavier than the females during January, June, August, November and December. Whereas, the significant differences were noticed during May and June ($P< 0.05$, $P<0.01$) only. The females were heavier than males during February to April, July, September, October, with significant differences ($P<0.01$) only in September.

Table 1

Mean monthly body weights (g±S.E.) of *R. rattus*

Months	Body weights Male (1)	Female (2)	't' between 1 & 2
January	94.12± 9.52	89.73± 5.00	0.40
February	79.50± 9.39	93.94± 4.00	1.41
March	93.27± 7.71	95.20± 7.31	0.71
April	59.50± 7.00	77.44±11.16	1.36
May	109.90± 8.83	76.25± 3.05	3.60**
June	87.40± 8.92	66.65± 6.36	1.89*
July	65.09± 9.19	78.15± 5.76	1.20
August	95.85±10.00	87.15± 5.76	0.73
September	72.13± 7.01	104.00± 9.47	2.70**
October	77.47± 7.21	81.33± 5.67	0.42
November	83.57± 5.30	80.26± 3.49	0.65
December	90.44± 9.47	84.00± 6.50	0.53
Annual average	75.88±11.30	77.07± 9.18	0.081

* = $P<0.05$
** = $P<0.01$

Sex ratios

The preponderance of female *R. r. rufescens* were observed almost throughout the year except March, September to November. Interestingly, males constituted a very low proportion (range: 32.4 to 40.0 per cent) in the population during February, May to July (Table 2). On an average, the female population outnumbered significantly (x^2 (1) 3.98, $P<0.05$) in the total sample size collected.

Table 2

Monthly variations in the sex ratios of *R. rattus rufescens*

Months	Male	Female	% of males
January	16	24	40.0
February	12	18	40.0
March	23	20	53.4
April	16	18	47.0
May	15	22	40.5
June	15	23	39.4
July	12	25	32.4
August	20	24	45.4
September	21	18	53.7
October	19	17	52.6
November	18	17	51.5
December	13	16	44.8
Total	200	242	45.4

Age structure

Among males, preponderance of subadults (upto 80 g. body weight) was during April, July-October and thereafter, in December, indicating ideal months for weaning of newly born

TABLE 3

MONTHLY DISTRIBUTION OF WEIGHT CLASSES OF MALE AND FEMALE RATS EXPRESSED AS PER CENT OF MONTHLY COLLECTION

Weight classes (g)	Months of year											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
						MALES						
20–50	25.0	25.0	17.3	56.2	33.3	13.3	41.6	30.0	42.9	15.8	27.8	30.8
51–80	6.2	25.0	30.4	12.5	6.6	33.3	41.7	3.0	42.9	52.7	27.8	30.7
81–110	37.5	25.0	26.0	25.0	26.6	20.0	—	2.0	4.8	21.0	33.3	23.1
111–140	18.8	16.6	21.7	6.2	26.6	33.3	16.7	1.5	9.4	5.2	—	7.7
141–170	12.5	8.3	—	—	6.6	—	—	5.0	—	5.2	—	7.7
171–200	—	—	4.3	—	—	—	—	—	—	—	—	—
						FEMALES						
20–50	12.5	16.6	15.0	27.7	31.8	39.1	4.0	25.0	22.2	11.9	11.7	25.0
51–80	20.8	11.1	20.0	16.6	50.0	30.4	56.0	29.1	16.6	41.1	53.0	43.7
81–110	58.3	33.3	30.0	27.7	18.2	17.4	16.0	29.2	22.3	29.4	35.3	25.0
111–140	14.2	27.7	30.0	22.2	—	13.0	24.0	12.5	30.3	—	—	—
141–170	14.2	11.1	5.0	5.5	—	—	—	4.2	—	17.6	—	6.3
171–200	—	—	—	—	—	—	—	—	5.6	—	—	—

young ones (Table 3). During April to August and then from October to December, the sub-adult females were recruited in natural populations in larger numbers. The body weight classes of 81-110 g and 111-140 g are more common in case of male rats, whereas, 111-140 g is not represented in all months of the year. However, weight classes of 140-170 g and 171-200 g have discontinuous and scattered distribution in the monthly collections of population.

DISCUSSION

As female *Rattus rattus rufescens* litters throughout the year, on an annual basis, females were found heavier than males, though the difference was insignificant. Occurrence of heavier females in September coincides with relatively higher (22.2%) prevalence of pregnancy (Rana *et al.* 1982) in this month. Likewise, their low fertility rate (13.0%) as well as lowest body weights (66.65±6.36 g) are recorded in June. In comparison to the Desert gerbil, *Meriones hurrianae* which shows considerable fluctuations in body weight structure (Prakash 1972), such seasonal variations are not found in case of *R. rattus rufescens*. It may be because of green nutritious food available to *M. hurrianae* population only during monsoon months, whereas, in godowns, *R. rattus* has sufficient supply of food to maintain its body weight more or less at a constant level. This concept holds true in another field rat species, *Rattus meltada pallidior,* due to its habit of selective feeding in nature (Rana & Advani 1981), and hence much variation in body weight is expected (Rana & Prakash 1982).

On an annual basis, females outnumbered (54.6%) the males (Table 2) supporting general sex ratio pattern among mammals inhabiting the Indian desert (Prakash 1974). However,

in the congeneric field rodents, *Rattus meltada pallidior* during a two year study, males always predominated the trapped population (Rana & Prakash 1982). The predominance of female *R. rattus rufescens* was observed even during the months of their peak prevalence of pregnancies in July and December. This is in contrast to the observations made by Raczynski (1964) who opined that during pregnancy females restrict their movements and therefore are trapped in lesser numbers than males. In case of present study, collections of rats were made from protected environments in godowns where food and space are sufficient for unchecked growth of any pest population. Therefore, both sexes were encountered in sufficient numbers. Moreover, to maintain a high density of population all the year round, preponderance of female sex in a population is essential. Likewise, in case of *R. meltada* infesting the irrigated crop fields which provide ample food to them round the year, male percentages were lower than those of females even during the months when prevalence of pregnancy was maximum (Rana & Prakash 1982). It appears that not only activity pattern or behaviour but also food and space influence the sex ratios obtained by trapping in a free living rodent population. On a yearly basis, male to female ratio was 1:1.21 which deviated significantly X^2 $(_1)$ = 3.98; $P<0.05$) from the 50:50 expected ratio. However, during March, September and November males were collected in larger numbers than females, whereas, insignificant differences between male and female numbers were found in other Indian rodent species like *Tatera indica cuvieri* (Prasad 1961); *T. indica indica* (Jain 1970), and *Rattus cutchicus cutchicus* (Prakash *et al.* 1973).

In pooled data for both the sexes of subadults it was revealed that except January, during all months subadults are encountered significantly in greater proportions. This may be due to faster regulation of population, higher annual productivity rate (Rana *et al.* 1982) and occurrence of pregnant females in all months during the year.

On the other hand, greater proportions of subadult males were collected in the latter half of the year (July-December) of *R. meltada pallidior* in western Rajasthan (Rana & Prakash 1982) and during first half of the year from the same species in South India (Chandrahas & Krishnaswami 1974). The regular recruitment of subadult rats in the population may be due to continuous food supply and shelter available to house-rats in grain *mandis*. Secondly, higher rate of prevalence of pregnancy in a confined population, is also one of the main regulating factors.

Acknowledgements

We are grateful to Dr. H. S. Mann, Director, Central Arid Zone Research Institute, Jodhpur for providing facilities. We thank Dr. Ishwar Prakash, Professor of Eminence, C.A.Z.R.I. for encouragement and guidance during the course of study. Help of colleagues, Sarvashri Dev Raj and Mala Ram, Laboratory Technician for procuring the animals is also acknowledged. Thanks are also due to Shri Chander Darwarni, L.D.C. who typed the manuscript.

References

Advani, R., Rana, B. D. & Soni, B. K. (1981): The organ: body weight relationship in the House rat, *Rattus rattus rufescens* (Gray, 1837). *Zeit. Saugetierk. Mitteil. 29*: 1-5.

Chandrahas, R. K. & Krishnaswami, A. K. (1974): Ecology of the soft-furred field rat, *Rattus meltada meltada* (Gray) in Kolar, Mysore State. *J. Bombay nat. Hist. Soc. 70*: 447-457.

Cowan, P. E. & Prakash, I. (1978): House rats from the Indian Arid Zone. *Zeit. angew. zool. 65*: 187-194.

Jain, A. P. (1970): Body weights, sex ratio, age structure and some aspects of reproduction in the Indian gerbil, *Tatera indica indica* Hardwicke in the Rajasthan desert, India. *Mammalia, 34*:416-432.

Prakash, I. (1972): Ecotoxicology and control of the Indian Desert Gerbil, *Meriones hurrianae* (Jerdon) VIII. Body weights, sex ratio and age structure in the population. *J. Bombay nat. Hist. Soc., 68*: 717-725.

————(1974): The ecology of vertebrates of the Indian desert. Chapter XIII. in Biogeography and Ecology in India. Dr. Junk B. V. Verlag, The Hague: 369-420.

Prakash, I., Advani, R., Soni, B. K. & Rana, B. D. (1980): Evaluation of the poison base for the control of common house rat, *Rattus rattus rufescens* (Gray), *Zeit. angew Zool. 67*: 211-223.

Prakash, I., Rana, B. D. & Jain, A.P. (1973): Reproduction in the Cutch-Rock rat, *Rattus cutchicus cutchicus* in the Indian desert. *Mammalia, 37*: 452-467.

Prasad, M. R. N. (1961): Reproduction in the female Indian gerbil, *Tatera indica cuvieri* (Waterhouse). *Acta Zool., 42*: 245-256.

Raczynski, J. (1964): Studies on the European hare. V. Reproduction. *Acta Theriol., 9*: 305-352.

Rana, B. D. & Advani, R. (1981): Food composition of the metad, *Rattus meltada pallidior* in western Rajasthan. *Acta Theriol., 26*:129-132.

Rana, B. D., Advani, R. & Soni, B. K. (1982): Reproductive biology of *Rattus rattus rufescens* in the Indian Desert. *Acta Oecol.* Paris (In press).

Rana, B. D. & Prakash, I. (1982): Population structure of the metad *Rattus meltada pallidior* in the Thar desert. *Zeit. angew. Zool.* (In press).